GEOTECHNICAL INVESTIGATION FOR PROPOSED WORK AT DR K SHIVARAMA KARANTH LAYOUT, SECTOR 8, BDA, YELAHANKA, BANGALORE

Report for

Client

M/s Ramalingam Construction Company Pvt Ltd

No 1 , NR Tower, Sirsi Circle to Binny Mill Road,

Near ETA Namma Mall, Ranganatha Colony,

Bengaluru

Report No – GCS-03-30901-31/10

Location: Dr K Shivarama Karanth Layout, Sector No - 8

Kalatamahalli

FOR 50MLD STP

M/s GOOLY CONSULTANCY SERVICES

ISO 9001:2015 CERTIFIED & NABL ACCREDITATED LABORATORY AS PER ISO/IEC – 17025:2017

No. 230, Opp. G R. Lavender Apartments, Sai Enclave Layout,
Kothanur Dinne, J. P. Nagar, 8th Phase,
Bengaluru- 560076

Tel: 080-42277023, 8971585823

Email: goolylab@gmail.com, info.gooly@gmail.com, www.goolyconsultancy.com

ABBREVIATIONS

LL	–	Liquid Limit
PL	–	Plastic Limit
PI	–	Plasticity Index
SPT	–	Standard Penetration Test
RQD	–	Rock Quality Designation
CR	–	Core Recovery
C	–	Cohesion
Φ	–	Angle of Internal Friction
NP	–	Non Plastic
UCS	–	Unconfined Compressive Strength
G	–	Specific Gravity
NMC	–	Natural Moisture Content
GWT	–	Ground Water table
DS	–	Disturbed Sample
UDS	–	Undisturbed Sample
RL	–	Reduced Level
SBC	–	Safe Bearing Capacity

Geotechnical Investigation for Proposed Work at Dr K Shivarama Karanth Layout, Sector 8, BDA, Yelahanka, Bangalore

1 INTRODUCTION:

M/s Gooly Consultancy Services were commissioned for carrying out Geotechnical Investigation for the **Proposed Dr K Shivarama Karanth Layout, Sector No 8, BDA, Bangalore** by the client **M/s Ramalingam Construction Company Pvt Ltd.** The work involved field study of the soil condition as per the geotechnical investigation specifications. This report presents the results of the investigation along with an assessment of the soil type, its bearing capacity, its physical behavior etc. and guidelines regarding the proposed foundation.

2 PURPOSE OF STUDY:

- The overall purpose of this study is to investigate the stratigraphy at the site and to develop geotechnical recommendations for foundation design and construction. To accomplish these purposes, study was conducted in the following phases:
- Ten numbers of Boreholes of size 100 mm dia were drilled using manual Auger up to refusal depth in order to ascertain the sub-soil strata.
- Conducting SPT tests in the borehole at 1.50-meter intervals depth or when change of strata, whichever is earlier as per IS 2131-1981
- Collecting representative soil samples at different depths in the Borehole as per IS 1892 - 1979.
- Analyzing all field and laboratory data.
- To evaluate allowable safe bearing capacity of soils to design foundations

3 LOCATION OF PROJECT SITE:

The proposed Work is located at Dr K Shivarama Karanth Layout, Sector No 8, BDA, Yelahanka, Bangalore. The investigation was carried out at ten locations as shown by the client.

4 FIELD METHODOLOGY

4.1 Soil Investigation:

The sinking of the boreholes were carried out by employing auger technique using a Manual Auger. The boreholes were drilled up to 1.5m depth from the existing ground level (EGL). Disturbed samples were collected from the borehole in split spoon sampler during drilling at appropriate depths and logged. After completion of the drilling boreholes were kept under observation for ground water monitoring for 24 hours after which they were backfilled.

4.2 Standard Penetration Test:

The Standard Penetration Tests was conducted at regular intervals in the boreholes to determine penetration resistance as per IS 2131-1981. The no. of blows was recorded at every 15-cm penetration up to 45 cm penetrations. The number of blows required to drive the sampler for 30 cm beyond seating drive is termed as penetration resistance 'N'. Refusal is said to have been reached when the sampler penetrates less than 15 cm under 50 blows. The Standard Penetration Tests (SPT) was conducted at the boreholes using the split spoon sampler as per IS-2131-1981 at various depths to determine the 'N' value of the soil.

SPT 'N' values are co-related with relative density of non-cohesive stratum and with consistency of cohesive stratum. Co-relations are tabulated below.

Table 2 - Co-Relation for Saturated SAND/ Non-Plastic SILT (Ref: IS 6403)

Relative density	N Value
Very Loose	0 to 4 Blows
Loose	4 to 10 Blows
Medium	10 to 30 Blows
Dense	30 to 50 Blows
Very Dense	50 and above

Table 3- Co-Relation for Saturated CLAY/Plastic SILT (Ref: IS)

Relative density	N Value
Very Soft	0 to 2 Blows
Soft	2 to 4 Blows
Medium Stiff	4 to 8 Blows
Stiff	8 to 15 Blows
Very Stiff	15 to 30 Blows
Hard	30 and above

5 SAMPLING AND LABORATORY TESTING:

Disturbed samples of the formation were collected from the boreholes in split spoon sampler and rock core samples by core barrels during drilling. These samples and the return water sludge were visually examined, logged and preserved for future reference.

The following laboratory tests were conducted on the Soil samples collected from boreholes:

Soil:

Natural Moisture Content as per IS 2720 (Part 2) – 1973.

Grain Size Analysis as per IS 2720 (Part 4) – 1985.

Liquid limit & Plastic limit per IS 2720 (Part 5) – 1985.

These tests were conducted as per the guidelines given in relevant Indian Standards. The test results are tabulated in Annexure IV.

6 GROUND WATER CONDITION:

Groundwater was not encountered in the boreholes at this site during the time of conducting the field investigation. No long-term monitoring of ground water was specified. Thus, the ground water conditions established is applicable for the time of investigation only. The ground water condition is subjected to climatic changes and any changes in the surrounding area. Reconfirmation of groundwater level is recommended prior to any work relating to the ground water regime.

7 CALCULATION FOR OPEN FOUNDATION:

OPEN FOUNDATIONS - BASIS OF APPROACH

Based on sub-soil profile noticed, open foundations have been considered for various structures. IS-6403 approach has been adopted idealizing the stratum as sandy soil.

A. SBC calculations for Isolated Footing

Safe Bearing Capacity (SBC) is calculated by using the procedure described in IS: 6403-2002. Ultimate bearing capacity is given by,

$$Q_u = c\, N_c\, s_c\, d_c\, i_c + \gamma\, D\, (N_q - 1)\, s_q\, d_q\, i_q + 0.5\, \gamma\, B\, N_\gamma\, s_\gamma\, d_\gamma\, i_\gamma\, w'$$

Where, Q_u	=	Ultimate net bearing capacity
c	=	Cohesion of stratum-Ignored
γ	=	Bulk Density
D	=	depth of footing = Minimum 1.5m
B	=	Width of footing considered
N_c, N_q and N_γ	=	Bearing capacity factors
s_c, s_q and s_γ	=	Shape factors, d_c, d_q and d_γ = Depth factors
i_c, i_q and i_γ	=	Inclination factors,
w'	=	Water table correction
ϕ	=	Angle of internal friction

General shear failure condition to occur

B. SETTLEMENT CRITERIA (IS-8009 (Part-I) Approach)

The magnitude of settlement, when foundation loads are applied, depends upon the compressibility of the underlying strata and rigidity of the substructure. The safe bearing pressure is evaluated for Total settlement 50 mm for rectangle footing as per table 1 of IS : 1904.

8 RECOMMENDATIONS:

The Safe bearing pressure considering isolated footings, at different foundations depths for allowable settlement of 50mm from existing ground level are as given below.

Isolated Pad Footing

Sr No	Depth of Foundation from lowest existing ground level (m)	Allowable Bearing Pressure (T/M^2)	Width of Footing (m)
1	1.5	25	1.5

The foundation excavation up to the recommended depth is possible by mechanical means. Care should be taken to ensure that the foundation soil is not disturbed during excavation. No loose portion may be left on the excavated floor at founding depth. The excavated floor may not be left open to nature for long and it may be well compacted before the foundation concrete is laid.

9 DISCLAIMER:

The interpretation and guidelines contained in this report are based on result of Boreholes and laboratory test conducted at the time of the investigation. The sub-surface conditions inferred from the data are indicative for the test location and the period in which tests have been carried out, the accuracy of which cannot be assured for locations and time other than those investigated. Additional Investigation may require necessary in case of any change in alignment and change in location of station structures.

For
Gooly Consultancy Services

BORELOGS

GOOLY CONSULTANCY SERVICES

BORE LOG

Project: Geotechnical Investigation For Proposed Work at Dr K Shivarama Karanth Layout, Sector 8, BDA, Yelahanka, Bangalore

Date of commencement: 31.08.2023

Date of completion: 31.08.2023

Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 1

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing:

Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	30/42/50R for 5cm			
1.0									
2.0						N>50			
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

UDS - Undisturbed sample

R - Rebound

* - Sample not retrieved

C- Core

Engineer In Charge: Vivek

GOOLY CONSULTANCY SERVICES

BORE LOG

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Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 2

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing: Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	25/30/50R for 8cm			
1.0									
2.0						N>50			
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

UDS - Undisturbed sample

R - Rebound

* - Sample not retrieved

C- Core

Engineer In Charge: Vivek

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Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 3

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing: Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	50R for 5cm			
1.0									
2.0						N>50			
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

UDS - Undisturbed sample

R - Rebound

* - Sample not retrieved

C- Core

Engineer In Charge: Vivek

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Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 4

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing: Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	23/30/50R for 4cm			
1.0									
2.0						N>50			
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

UDS - Undisturbed sample

R - Rebound

* - Sample not retrieved

C- Core

Engineer In Charge: Vivek

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Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 5

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing:

Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	30/45/50R for 8cm			
1.0									
2.0						N>50			
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

UDS - Undisturbed sample

R - Rebound

* - Sample not retrieved

C- Core

Engineer In Charge: Vivek

GOOLY CONSULTANCY SERVICES

BORE LOG

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Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 6

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing:

Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	30/50R for 6cm			
1.0						N>50			
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

UDS - Undisturbed sample

R - Rebound

* - Sample not retrieved

C- Core

Engineer In Charge: Vivek

GOOLY CONSULTANCY SERVICES

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Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 7

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing:

Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	32/43/50R for 6cm			
1.0						N>50			
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

UDS - Undisturbed sample

R - Rebound

* - Sample not retrieved

C- Core

Engineer In Charge: Vivek

GOOLY CONSULTANCY SERVICES

BORE LOG

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Date of completion: 31.08.2023

Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 8

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing:

Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	36/45/50R for 8cm			
1.0						N>50			
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

R - Rebound

C- Core

UDS - Undisturbed sample

* - Sample not retrieved

Engineer In Charge: Vivek

GOOLY CONSULTANCY SERVICES

BORE LOG

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Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 9

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing:

Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	35/47/50R for 4cm			
1.0						N>50			
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

UDS - Undisturbed sample

R - Rebound

* - Sample not retrieved

C- Core

Engineer In Charge: Vivek

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Client M/s Ramlingam Construction Company Pvt Ltd

Ground water table: Not Encountered

BH No. 10

Reduced Level -

Location: Kalatamahalli

Method: Manual Auger

Northing:

Easting:

Depth below Existing GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Remarks
				Type	Depth (m)				
0.0	Reddish Brown Hard Clayey Sandy SILT with occasional Gravel	1.5		SPT	1.5	25/43/50R for 4cm			
1.0									
2.0						N>50			
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

BH was terminated at 1.5m depth from Existing ground level.

Note :

SPT - Standard penetration test

UDS - Undisturbed sample

R - Rebound

* - Sample not retrieved

C- Core

Engineer In Charge: Vivek

LABORATORY TEST RESULTS

Laboratory Test Results of Soil Samples

BH NO	Depth (m)	NMC (%)	Grain Size Distribution (%)			Atterberg Limits (%)		
			Gravel	Sand	Silt/Clay	Liquid Limit	Plastic Limit	Plasticity Index
BH 01	1.5	11.4	0.0	32.5	67.5	37	22	15
BH 02	1.5	-	1.5	39.5	59.0	36	22	14
BH 03	1.5	11.0	44.5	39.0	16.5	-	-	-
BH 04	1.5	-	0.0	40.5	59.5	34	21	13
BH 05	1.8	10.9	1.0	59.0	40.0	32	21	11
BH 06	2.0	-	2.5	20.5	77.0	39	21	18
BH 07	1.7	-	0.0	46.5	53.5	39	22	17
BH 08	1.5	11.2	1.0	38.5	60.5	-	-	-
BH 09	2.3	-	0.0	23.5	76.5	37	21	16
BH 10	1.0	11.5	1.5	39.5	59.0	-	-	-

SAMPLE CALCULATION